System for Spin Randomization of Electrons Not Dependent Upon Spin Randomization Crystals in Support of Wear-Prevention in Lithium Ion Batteries

15 September 2023
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Introduction

Although revolutionary, the incorporation of spin randomization crystals witin the anodes of lithium ion batteries substantially increases the cost of manufacture of the batteries, making the approach suitable only in circumstances in which cost is not a factor. For commercial viability, battery life must be extended utilizing more cost-effective methods.

Abstract

Wear in lithium battery anodes is fundamentally driven by consistencies in the spin orientation of electrons moving toward the cathode and the effect of their discrete magnetism upon the anode. Not unlike a carpet worn out by being walked upon excessively, the anodes of these batteries are subject to wear. While wear can never be entirely eliminated, a cost-effective method for mitigating this wear would decrease the year-over-year cost of ownership of electric vehicles and extend the service life of satellites dependent upon such batteries.

Wear is generated both during the charge and discharge of voltage cells, making unnecessary charge or discharge activity ostensibly undesirable. When one considers the weakness of the magnetic moment of the individual electrons creating wear in anodes, one realizes that it is only through consistent wear at specific angles of orientation that anodes can become corrupted. When water erodes stones, making them smooth, the water washes over the stone from multiple directions at the microscopic level, even when water is flowing in a single general direction. Water erosion of stones results in smoothing, but it never results in the stones cracking in half. Lithium battery anodes behave quite differently from an eroding stone in flowing water.

The more symmetrical the wear in the lithium battery anode, the less rapidly wear would occur generally. Just as the rate of erosion of a stone in water is proportional to its surface area i.e. the rougher it is in the first place, the more atoms of material are eroded in the same period of time. This being the case, taking actions that actually result in a greater number of total electrons flowing through the battery on a per-charge-cycle may seem counter-intuitive. However, under certain circumstances, it may actually result in less wear given that it is not erosion we are concerned with, but rather, anode distortion. Wear is not determined by flow or by heat, in the case of the anodes, but rather, the product of magnetic moment and time with regard to specific regions of the anode's exposure to that moment.

This is particularly true given the tendency of anode material to retain small quantities of magnetism bestowed upon it by the discrete magnetic fields of the flowing electrons. Although these anodes are not composed of ferromagnetic materials, these materials may store and exert their own discrete magnetism against neighboring particles provided that flow characteristics of electrons are uninterrupted over timescales longer than several microseconds i.e. they are paramagnetic.

Rather than augmenting anodes with additional, difficult-to-incorporate physical structures that alter the spin orientation of electrons as they flow in service of the prevention of the accumulation of magnetic nano-torsion of anode materials, batteries may instead be augmented through the incorporation of what may be termed an Electron-Regurgitant Flow Inverting Shell (ERFIS) and an Electron-Regurgiant Flow Inverting Core (ERFIC.)

These capacitors would be nanoscopic in scale and would form a shell just outside (nanometers apart from) the anode, with a fluid electrolyte filling that narrow space as it does the remainder of the space between cathode and anode. These capacitors would divert electricity flowing toward the cathode into itself and permit excess electricity to continue flowing toward the cathode for use by the user. These capacitors would, upon reaching full charge, dump their accumulated charge in the inverse direction (during discharge of the voltage cell) millions of times per second. The intent in doing this is not to attempt to recharge the voltage cells, but rather, to introduce a force that has random and unpredictable interactions with the outflowing electrons from the anode. The electrons regurgitated into the anode against the prevailing direction of flow would act like a handful of rogue persons moving against a crowd, causing their overall flow to be perturbed and for those electrons and their spin orientations to vary randomly. This random variance is key in the prevention of anode distortion over time. A relatively weak counter-current can so randomize the magnetic orientation of outflowing electrons that magnetic moment cannot accumulate and be transducted by paramagnetic atoms within anodes into deeper-level atoms in the material.

In continuation of the analogy of the carpet, if force is applied to that carpet without ever fully compressing or tugging at the fibers of that carpet (tugging at the point where it is rooted in the substrate) then true wear is unlikely to occur. For an anode in a battery, atoms dozens or hundreds of atoms beneath the surface must experience torsional forces in order for the anode to become corrupted. If magnetic moment is never transmitted in a unified direction for any meaningful length of time, that cascade of moment can never reach a sufficient depth to cause a distortion. As we are not concerned with erosion, but only with distortion, ensuring that these magnetic forces are applied randomly and only over extremely short intervals (made possible by the magnetic moment-randomizing effects of the counterflowing electrons) would, even over tens of thousands of charge/discharge cycles, preclude any possibility of meaningful distortion of anodes.

A second ERFI system would logically be emplaced at the core of the anodes to facilitate the same wear-preventing effects during the charge of the voltage cells. That ERFIC would be activated, logically, only during the charging process and the anode-exterior layer (ERFIL) would activate only during the utilization (discharge) of the voltage cells.

Conclusion

The incorporation of nanocapacitors of the aforementioned sort that charge and discharge according to pre-set timings and in a manner responsive to and dependent upon overall flow direction would not dramatically increase the cost of manufacture of lithium ion batteries but would, if implemented as prescribed, increase the lifespan of such batteries by a minimum of 25-fold.